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ABSTRACT

This examination of the use of telecommunications systems in the health care field in Canada notes that the use of such systems to assist in the delivery of health care at a distance is critical to the remote and isolated regions of the country. The report begins by reviewing the development of 'telemedicine' or 'telehealth' systems using various combinations of telephone, cable, microwave, and satellite technologies. Examples of such systems are provided by describing three experiments with linking hospitals in remote areas with urban teaching hospitals. The remote hospitals were the Moose Factory General Hospital in the northern district, the Sioux Lookout Zone of northwestern Ontario, and four remote hospitals in Newfoundland. Technologies included linking via the Hermes satellite and/or slow scan television; applications ranged from medical diagnosis and consultation to administration, continuing education for health professionals, and patient treatment. Current telehealth applications in Canada are then described, including programs operating in British Columbia, Alberta, Manitoba, Ontario, Quebec, New Brunswick, and Newfoundland. Issues involved in planning for telehealth programs are also discussed, including whether video is needed in addition to audio, protection of patient-physician confidentiality, remuneration for services rendered via telecommunications, and the need for more expertise and guidance in creating the programs to be transmitted. A look at future directions for telehealth in Canada concludes the report. (20 references) (DB)

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NEW TECHNOLOGIES IN CANADIAN EDUCATION

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PAPER 15

TELEHEALTH: TELECOMMUNICATIONS TECHNOLOGY IN HEALTH CARE AND HEALTH EDUCATION IN CANADA

By Jenny Cervinskas

Study Coordinator
Ignacy Waniewicz

January 1984

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Papers in the Series

NEW TECHNOLOGIES IN CANADIAN EDUCATION

Paper 1	An overview of the educational system in Canada
Paper 2	Communications and information technologies in Canadian elementary and secondary schools
Paper 3	Communications and information technologies in community colleges in Canada
Paper 4	Communications and information technologies in Canadian universities
Paper 5	Communications and information technologies and distance education in Canada
Paper 6	Communications and information technologies and the education of Canada's native peoples
Paper 7	The provincial educational communications organizations in Canada
Paper 8	Educative activities of the Canadian Broadcasting Corporation and the National Film Board of Canada
Paper 9	Applications of new technologies in nonformal adult education in Canada: Two examples
Paper 10	Canadian cable television and education
Paper 11	Educational applications of videotex/Telidon in Canada
Paper 12	Educational applications of communications satellites in Canada
Paper 13	Educational videodisc in Canada
Paper 14	Educational teleconferencing in Canada
Paper 15	Telehealth: Telecommunications technology in health care and health education in Canada
Paper 16	The high technology industry and education in Canada
Paper 17	New technologies in education in Canada: Issues and concerns

Copies of these papers can be purchased from TVOntario, Box 200, Station Q, Toronto, Ontario, Canada M4T 2T1.

FOREWORD

We dedicate this series to its designer and director, Ignacy Waniewicz. His death on February 21, 1984, has left us with a feeling of immeasurable loss.

With uncanny intelligence, instinct, and energy, Ignacy introduced the first educational television programs in his native Poland in 1957 and rose to the position of Director of Educational Broadcasting. During the mid-1960s, he served as a Paris-based program specialist in the educational use of radio and television, working for UNESCO in Chile, Cuba, Ivory Coast, Upper Volta, Mexico, Egypt, Nigeria, Senegal, Ghana, Great Britain, United States, Switzerland, and Israel. Ignacy shared the experience and insight he gained from this work by teaching and writing in Polish, German, Russian, Hebrew, Spanish, French, and English. His achievements are widely recognized in the broadcasting and academic communities on four continents.

As Director of the Office of Development Research at TVOntario, Ignacy explored his farsighted and consuming interests in adult education, media literacy, television as a primary tool for lifelong learning, and most recently, the educational uses of new technologies. His work did much to shape and guide TVOntario's progress over the last 15 years.

It is with love and respect that we dedicate this series to Ignacy Waniewicz. In its enormous scope, its thorough documentation, its emphasis on concrete results, and its concern with educational issues, this series reflects both Ignacy's vision and his intellectual legacy.

Donna Sharon
for the Office of Development Research

Preface to the Series

NEW TECHNOLOGIES IN CANADIAN EDUCATION

These papers in the series "New Technologies in Canadian Education" are the result of an international commitment. In June 1980, the Third Conference of Ministers of Education of Member States of the European Region of UNESCO adopted a recommendation requesting the member states to carry out joint comparative studies on well-defined problems of common interest in education. At a subsequent meeting of the European Region National Commissions for UNESCO, 14 subjects were agreed on for joint studies.

The theme "New Technologies in Education" was selected as study #11. The 17 countries participating in the study are Austria, Belgium, Denmark, Finland, France, Hungary, Italy, the Netherlands, Poland, Spain, Sweden, Ukrainian SSR, USSR, United Kingdom, as well as Canada, Israel, and the U.S.A. who are also members of the UNESCO European Region. At the first meeting of the national coordinators from these countries, held in October, 1982, at the University of South Carolina in Columbia, South Carolina, U.S.A., a plan was adopted for the study. In the first phase of this plan, the individual countries are to report on the ways in which the new technologies are being used in education. (A brief outline of the international design is available on request.)

The Canadian Commission for UNESCO was requested to coordinate, on an international level, the first year of the study. We are grateful to the Canadian Commission for selecting TVOntario, and the Office of Development Research (ODR) to be in charge of this task. The ODR was also asked to coordinate the Canadian contribution to the study, with financial support from the Department of the Secretary of State. We gratefully acknowledge their assistance.

In preparing the Canadian review of the use of technology in education, the ODR contacted a number of educators, academics, government officials, administrators in educational communications organizations, and others, across the country. It became apparent that there was a strong need for a well-documented account of the uses of both the "older" technologies (e.g., film, audio, television) and the newer technologies (e.g., computers, videodiscs, videotex) in the complex Canadian educational system.

Early in 1983, several types of research activities began simultaneously: designing instruments to gather information from each type of institution or interest group, identifying uses and users of each type of technology, and exploring the areas where Canada's distinctive features predispose toward technological developments. The 17 papers listed on the back of the title page emerged as a result.

Information for these papers was provided by hundreds of individuals expressing their own views or reporting on behalf of educational institutions and organizations, government departments, public and private corporations. We extend to them our sincere thanks.

I would like to acknowledge the contribution made by Thelma Rosen who assisted in the development of the inquiry instruments and played a major role in the gathering of this information. The task of supervising the final editing, production, and distribution of the papers was assigned to Donna Sharon. Her resourcefulness and persistence have contributed greatly to the completion of this series. Sharon Parker typed most of the papers from the initial drafts to their final versions. Her dedication made it possible to complete the study in such a relatively short period.

While the preparation of these papers has been supported by the Canadian Commission for UNESCO and the Department of the Secretary of State, the papers' contents do not necessarily reflect the official views of either party on issues related to technology in education.

Ignacy Waniewicz
Study Coordinator
Director
Office of Development Research
TVOntario

January 1984

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INTRODUCTION

The trend in Canada toward greater use of telecommunications in the health care system and in continuing medical education is now well-established, and shows little sign of slowing down. In fact, it is expected to continue unabated as people come to accept the technology, as the cost of travel continues to rise and as the benefits of the technological advances continue to be demonstrated.

Canada, which is geographically the largest country in the Western Hemisphere and the second largest in the world, faces unique difficulties in delivering health care. Eighty-nine per cent of the country contains no permanent settlement, and outside the urban-rural blocks, where most of the population is concentrated, there are numerous unconnected settlements based on mining, forest industries, transportation, administration, defence or hunting, and fishing.

The climate and the remoteness of many communities deter many health professionals from working in rural or isolated areas, with the result that medical services are unevenly distributed. Specialists are especially scarce in rural areas, largely because they need increasingly complicated and expensive diagnostic equipment and the personnel to operate it. Consequently, there is a growing concentration of health care resources, both human and technological, in the more populated regions (mainly in the southern part of the country) and a concurrent underdevelopment of rural health services. For example, in 1977 the number of residents for every active physician was 566 for the country as a whole, but 1,294 in the Northwest Territories.[1]

The centralization of health care resources can create problems in the treatment of the sick. When the nearest appropriate health facility is hundreds of kilometres away, the journey may be delayed or prevented by cost, geography, or weather. In some situations, a journey would be unnecessary if the remote area could communicate more fully with other medical or specialty personnel.

In order to provide high-quality health care services, medical personnel require continuing education programs. Knowledge in the health field is expanding at an incredible

rate, and keeping current is difficult when the annual output of medical research literature exceeds a quarter of a million articles in over 20,000 journals.[2] For that reason, continuing education must be provided for health care workers if the patients are to benefit from the new knowledge. While organized courses in continuing education are offered in most larger cities, the rural practitioner often cannot attend them. Travel costs are high, bad weather and lack of time usually prevent the worker from taking advantage of the many courses, conferences, meetings, and other educational events.

Escalating costs and the desire to make the most efficient use of the faculty's time have also made it increasingly difficult to send speakers to distant locations, or to offer courses for the usually small number of persons working in health care in rural or isolated areas.

For these reasons, the rural practitioner is left with few possibilities for continuing his or her education. Individual reading is probably the most common method of trying to remain current in one's field, and for many years now, efforts have been underway to provide the rural health care provider with opportunities for distance learning. Correspondence courses, audiotapes, videotapes and, in some cases, public radio and television have all been used in continuing medical education.

All of these approaches have a serious shortcoming: they do not give the learner the chance to ask questions, to seek clarification, or to express different opinions. Consequently, there is much dissatisfaction among learners.

In the face of the difficulties in health care delivery in Canada, the obvious question that needs to be addressed is: How can access to good-quality health care be improved in underserviced areas?

One possible answer is to be found in what is now being called "telehealth," i.e., the use of telecommunications technology in medical treatment and education. Indeed, modern telecommunications present new and challenging ways to bring people together for purposes of communication and thus to improve the delivery of health care.

The intent of this paper is to report on some of Canada's recent innovations in telehealth. While the main subject

will be the evolution of telehealth in Canada, with descriptions of recent examples, the paper will also discuss what can be learned from previous experiences, the issues that have emerged from those lessons, and future directions in telehealth.

DEFINITIONS

A number of terms are used to describe the use of telecommunications technology in the health care field: telehealth, telemedicine, tele-education, teleconsultation, teleconferencing, and telediagnosis are just a few. The prefix "tele" (which is Greek for "at a distance") is used to signify that the communication is taking place over a distance and that communications technology is being used. The term that is heard most often, though, and that embraces almost all of the labels, is telemedicine.

Telemedicine means literally "medicine at a distance." In its brevity though, this definition is not specific enough, and workers in the field have sought other more informative working definitions. One commonly accepted definition is that of A.M. Shinn who defines telemedicine as: "...situations in which health care professionals use telecommunications channels to communicate with each other or with their patients, with the goal of improving in some way the delivery of health care services".[3]

E.V. Dunn, D.W. Conrath, and C. Higgins have captured the essence of this definition and distilled it: "Telemedicine is the use of telecommunications technology to assist in the delivery of health care."[4]

Some workers in the field take exception to the term "telemedicine" and advocate instead the term "telehealth." For example, some believe that "telehealth" implies a broader range of health-related activities than telemedicine does.[5]

In light of the current applications of communications technology to the field of health and the broad range of applications, "telemedicine" and "telehealth" will be used interchangeably in this paper to mean "the use of telecommunications systems to assist in the delivery of health care at a distance."[6]

RANGE OF APPLICATIONS

People are the ultimate subject of health care. Whether the need is for prevention, cure, or information, there is a large medical care system working to provide health care services. The system is composed of numerous, interlocking components which, for ease of discussion, can be grouped under the following headings:

- Medical diagnosis, consultation, and treatment;
- Administration;
- Social-therapeutic services for patients and family or friends;
- Education, for both health professionals (particularly undergraduate training, and continuing education or up-grading training) and for the public.

As shall be seen in the case descriptions, all of these aspects of health care can be affected by the use of telecommunications technology.

TECHNOLOGIES IN USE

The telecommunication systems used in Canadian telehealth projects are among the most extensive and sophisticated in the world. Telephone, cable, microwave, and satellite are used in various combinations that can link two people or hundreds. (Paper 14 describes the use of telecommunications equipment in educational teleconferencing.)

Most of the communications systems used are audio-only systems where participants can hear and speak to each other. These systems are used mainly for administrative purposes and to conduct educational sessions among learners in different locations. Audio plus refers to the addition of visual materials, including print, photographs, videotape or slow-scan technology. For example, slow-scan technology can be used to transmit pictures and Xray images over telephone lines to a television receiver. Its ability to add a visual dimension has made it increasingly feasible to use the telephone system in diagnosis and consultation.

Video systems, with a full-motion video component as well as an audio component, are also a part of the current telemedicine scene. The transmission of video signals (via microwave, cable or satellite) is permitting new telehealth applications to be developed, with either one-way video or two-way video communication.

THE DEVELOPMENT OF TELEHEALTH IN CANADA

Owing largely to the Canadian and American space programs, the advance to this stage of telecommunications in health has proceeded very rapidly over the past decade. E.V. Dunn and C. Higgins claim that telemedicine's early history is more extensive than is generally appreciated,[7] and they cite examples of the use of telecommunications technologies (from radio to telephone and television transmission by cable or microwave) for medical consultations, diagnosis, education, and other health applications throughout this century.

> "Under the direction of Dr. Max House, Memorial University, Newfoundland, undertook experimentation with a variety of technologies - from an augmented telephone system that permitted audio teleconferencing, through the use of slow-scan television, and finally experimentation in using satellites. A similar experience occurred in the province of Quebec, with many efforts being directed at the provision of health care services to the more remote regions of the province, specifically the James Bay hydro development project area. Links were made to university medical school centres in Montreal. In addition, several of the community hospitals in the Laurentians north of Montreal have for some years had their ECGs transmitted to and interpreted by physicians in tertiary care centres in Montreal. A recent figure indicated more than 35,000 of these interpretations per year were carried out on this telecommunications system.
>
> "In Ontario, an experience reported elsewhere linking two of the University of Toronto teaching hospitals to Sioux Lookout and some of the more remote nursing outpost stations has been going for approximately seven years. Under the direction of Dr. Earl Dunn of Sunnybrook Hospital, a link between The Hospital for Sick Children and Sunnybrook Hospital to Sioux Lookout utilizes slow-scan television for the reading of Xray films and ECGs. Adaptation for other purposes has also been attempted.
>
> "Finally, for a number of years now the two main teaching hospitals of the University of Manitoba's medical school have been linked in Winnipeg to facilitate primarily educational exchanges."[8]

While the potential and effectiveness of using telecommunications systems for health applications have thus been demonstrated for many years, the reach of projects attempted (and even the possibility of projects) has been limited by the use of terrestrial systems. In many regions, the population is so sparse or the terrain so rugged that the cost of developing ground-based networks could not be justified; hence, it was often impossible to link points hundreds of kilometres apart. Where linkages were made, communication was often impeded by poor transmission.

So, while there were many applications of telecommunications technology in the health field, it was not until the advent of satellite technology that the "old" technical concepts were refined to make "health care at a distance" truly feasible. (See Paper 12 for a discussion on the use of communications satellites for educational purposes.)

Communications satellite technology, in which Canada is a world leader, may affect the future of telehealth dramatically. The advantage of satellites is their ability to link points separated by vast distances and mountainous terrain without additional cost. For example, three large satellites are capable of bringing television, radio, telephone and computer data to every square inch of the earth's surface. Satellites can thus be conceived of as a powerful extension of existing earth-bound communications facilities.

Although satellite transmission costs do not vary with distance, the initial capital outlay for satellite installation is considerable. Thus, land-based communications systems which are already in place are generally more economical than the introduction of a satellite network.

> "Satellite time remains quite expensive, in part at least because of a decision by Telesat Canada not to allow small users direct access to satellite channels. As a result, hospital users would have to approach the common carriers - Bell Canada or CN/CP Telecommunications - in order to 'rent' satellite time. The presence of a 'middle man' between the persons responsible for the satellites and those wishing to use them adds an unnecessary cost. In late November 1981, it was

announced that Telesat had changed its policy in this regard, but regrettably the Federal Cabinet apparently reversed this decision. It is anticipated however that with increasing use of satellite time, small users may have direct access to the satellites, and as the satellites become more powerful, and greater utilization is made of them, the costs will in fact be diminished."[9]

A number of experiments were undertaken in Canada in the 1970s, primarily in Ontario and Newfoundland.

Moose Factory

The first Hermes experiment was conducted from October, 1976, to February, 1977. Its purpose was to assess the use of telecommunications in providing consultative services to an isolated northern district hospital and an outlying nursing station. The project linked the one hundred twenty-five-bed Moose Factory General Hospital (MFGH), which served indigenous communities, to the Health Sciences Centre (HSC) at the University of Western Ontario in London in southern Ontario in such a way that video signals transmitted from Moose Factory could be seen and interpreted in London. There was also an interactive audio link.[10]

The experiment also included a nursing station in Kashechewan (approximately 220 kilometres north of Moose Factory), where a telephone terminal was installed to provide an audio link that would enable the nurses to speak to, and seek advice from the medical staff at the hospital in Moose Factory. Doctors in London could also give advice. Previously, the nursing station had only a high-frequency radio-telephone link to Moose Factory. Now for the first time, nurses in the north had a reliable and high-quality audio link to the hospital. Because satellites are not subject to atmospheric disturbances, the sound transmitted is usually of high quality.

Using this system, a consulting doctor in London was able to sit before a television monitor, control television cameras that were installed in a consultation room and in the Xray department in the Moose Factory hospital, and carry on a discussion with medical personnel in Moose Factory. Remote-controlled television cameras were also installed in an operating room and in a case room. It was possible for the

specialist in southern Ontario to supervise the operating room and case room and give advice and guidance as required. The significance of these achievements can truly be appreciated when one considers that in 1972 it took 24 hours by train for specialists to get to Moose Factory from University Hospital in London and as long as seven weeks for an electrocardiogram to be sent from Moose Factory to London and back.[11]

The Moose Factory hospital was also equipped to produce Xray and fluoroscopic films, which were sent by satellite and interpreted by experts at the University in London. While it has been reported that the system functioned effectively for 90 per cent of the radiologic and fluoroscopic examinations interpreted over the link, it was decided that the cost of broad-band satellite communications for live film interpretation precluded their regular use.[12]

Overall, this experiment showed that doctors in London could participate actively and successfully in the diagnosis and treatment of cases at MFGH, and could give advice, immediately if necessary, to the nursing station at Kashechewan. It was also found that the links provided a teaching aid and enabled medical staff to employ somewhat more complex procedures, knowing that help could be called upon if needed. Dr. Lewis Carey, Chief of Radiology at University Hospital and the experiment leader, was extremely enthusiastic about the project: "There is no doubt about the future of telemedicine - Canada is a natural for it!"[13]

Sioux Lookout Zone

One of the pioneer projects in telehealth in Canada is a slow-scan television system that has been operating since August, 1977, to assist with health care delivery in northwestern Ontario. The decision to proceed with this system was made after evaluating the findings of a well-designed research project which consisted of a number of controlled experiments designed by Drs. Conrath and Dunn.[16]

The project compared a number of different communication modes for medical consultations: color television, black and white television, still-frame black and white television, and audio-only teleconferencing. In evaluating the four alternative telemedicine systems, the researchers found no

significant differences between them in diagnostic accuracy, proportion of supporting investigations requested, time taken for diagnostic consultations or the effectiveness of patient management. It was concluded, therefore, that the least expensive mode is the most cost-effective.

Drawing upon the experiences and findings of the controlled experiments, researchers at the University of Toronto and the University of Waterloo designed a telemedicine project for the Sioux Lookout Zone health care system which delivers medical services to a remote population in northwestern Ontario.

With funding by the Physicians' Services Incorporated Foundation, a slow-scan video network was installed in the Zone in August 1977. The system uses the regular telephone lines, one for audio and one for video, with the video transmission giving a new television update every 78 seconds. The network is now operating out of six communities in the Zone: one at the seventy-bed Zone hospital, three in nursing posts, and two in outlying villages having only health aides. These sites are linked to two teaching hospitals in Toronto, one for adults and the other for children. (Sioux Lookout is about 1500 kilometres from Toronto, and the northern installations are another 400-500 kilometres away.)

While there was initial resistance and hostility to the system, after two years of operation the system was accepted. Use expanded, and the communication mode became an integral part of health care delivery. At the present time, the equipment is operated by regular health workers without expert help, and it is believed to provide a significant contribution to better and more personal care.

Originally established for medical diagnosis and consultation, the network is now being used with increasing frequency for educational purposes. Currently, the use of the system can be divided into three broad categories: (1) medical consultation (2) education of health care providers and (3) social-therapeutic contacts. While space does not allow a discussion of all aspects of the use of the system, some of the common applications in each area will now be described briefly.

Medical consultation. The majority of medical consultations which constitute regular use of the system have been for the transmission and interpretation of Xrays and ECGs but, on a limited basis, there have also been consultations regarding plastic surgery, physiotherapy, dermatology, dentistry, and microscopic slides. These consultations are seen as valuable educational experiences by health workers in the north. The transmission of data has facilitated discussion and clarification of problems, often aiding in medical diagnosis.

Educational sessions. The educational programs have been designed mainly for physicians and nurses, but other health professionals and students have also taken part, including health aides, pharmacists, nutritionists, ambulance attendants, and dentists. Programs in most medical and surgical specialties and subspecialties have been presented.

The programs that have used the slow-scan system have generally taken one of three forms: consultation, case presentation and discussion, or topic presentation and discussion. Some of the recent educational activities undertaken are outlined below:

- Weekly Xray rounds for the staff at the Zone hospital are held. Each week a senior radiologist in Toronto reviews Xray films selected by the Zone physicians. Although these rounds are held for educational purposes, they frequently result in changes in patient management.

- Once a month, a radiologist visiting the Zone hospital uses conference calls to conduct similar rounds for the nurses working at the three nursing stations equipped with the slow-scan equipment.

- Weekly ECG rounds are held between cardiology staff from Toronto and both medical and nursing staff in the remote sites.

- Occasionally, audio-only seminars or lectures followed by discussion are presented on a variety of topics in which the northern staff has expressed interest.

- The medical consultations are often taped and the tapes retained for in-service education.

For the seminars and lectures, support materials such as slides and handouts are distributed to the remote areas a few days before a session.

Social-therapeutic contacts. The telehealth system is used, when deemed necessary, to enable patients to communicate with their friends and families who may be hundreds of kilometres away. This has often helped to make patients feel less anxious and isolated.

Although there was some unwillingness to use the system during the early days of introduction, the resistance was largely gone after two years of operation. Today, the communication mode used is well accepted as an integral part of health care delivery in the Sioux Lookout Zone.

Satellite telecommunications in Newfoundland

In the eastern province of Newfoundland, a pilot project at the Memorial University of Newfoundland in St. John's used the Hermes satellite to link Memorial's Health Science Centre to four remote hospitals (in St. Anthony and Stephenville on the island and Labrador City and Goose Bay in Labrador).

The primary objective of the project was to assess the value of the telecommunications system for continuing education (and, to a lesser degree, for patient care) by providing one-way video and two-way interactive voice communication, as well as slow-scan technology for the transmission of medical data.[14]

To help prepare for the Hermes program, Memorial University received funding from the federal Department of Communications to establish a two-way microwave audiovisual link between the campus and its main teaching hospital (six kilometres away) permitting the rehearsal of most of the programs presented via Hermes. The Hermes program, co-sponsored by the Faculty of Medicine and the University's Educational Television Centre, took place over a period of 12 weeks from March to mid-June, 1977.

The consultation services provided with the system were limited because, although St. John's could broadcast audio and video signals, the other four communities could broadcast

voice only. Nevertheless, there were experiments with slow-scan transmissions from one of these locations.

The main activity of this project consisted of the transmission of continuing education programs to physicians and other health professionals in the four participating hospitals. In total, 150 hours of programs were produced, covering a wide range of topics. At the close of the project, it was concluded that, while it was indeed an effective method for transmitting educational sessions to remote groups, it was too expensive to adopt permanently or to aid in patient management. Furthermore, the researchers were not convinced that expensive real-time television was needed in order to meet the objective of providing continuing education for health professionals. Instead, they concluded that a two-way audio system or audio-plus was adequate for the applications tested in the project.

Links with offshore drilling rig

Further social and technical pilot projects via satellite have been conducted since the Hermes program, using the Anik-B satellite. This satellite, launched in December, 1978, served both as a commercial satellite and an experimental vehicle for exploring more fully the operational viability of some of the services that were tested with Hermes.

In the call for project proposals, telehealth projects were once again accepted. An exciting, challenging application of the Anik-B program in health at this time was the linkage in June, 1980, of the Health Science Centre in St. John's, Newfoundland, with an offshore oil rig in an attempt to study the delivery of health care to the rig.[15]

Owing to technical difficulties, the program was terminated after only 10 days. Yet it was felt that it was indeed possible to use telecommunications technology to deliver health care services to the offshore drill ship, and a commitment was made to continue research in this area. Phase II of Memorial's Anik-B Pilot Project has commenced. An automatically stabilized terminal has been installed on a semisubmersible rig in the Hibernia area. This pilot project, jointly sponsored by Memorial, the federal Department of Communications, and the Newfoundland Telephone Company, is evaluating the use of two telephone channels to

support health care on the rig and for industrial purposes. The prototype satellite terminal is also being evaluated. Already slow-scan transmission of Xrays and other pictures to support health care have been transmitted, and the transmission of ECGs has been demonstrated. This project will last for approximately six months.

These early telehealth experiences with Hermes and Anik-B formed the basis for many of the present day telemedicine applications.

CURRENT TELEHEALTH APPLICATIONS IN CANADA

Telehealth activities have become established in most provinces, using satellite, coaxial cable or telephone lines to offer full-motion video, audio-only or audio-plus communications capabilities. Programs now operating in British Columbia, Alberta, Manitoba, Ontario, Quebec, New Brunswick and Newfoundland are described in the following sections.

In both Saskatchewan and Nova Scotia, audio-teleconferencing services are still in the development stage. Following two successful pilot projects in 1978 and 1982, the Division of Continuing Medical Education at the University of Saskatchewan is now setting up a consortium of physicians, nurses, pharmacists, technicians and administrators. Demonstrations of activities for each group are now being conducted to assist in developing and planning an ongoing service, directed primarily at medical personnel in remote locations. A teleconferencing service is also being developed by the Continuing Medical Education division at Dalhousie University in Halifax, Nova Scotia, to serve groups of medical specialists in nine communities across Nova Scotia, New Brunswick and Prince Edward Island. Two pilot projects are underway, one for pediatricians and one for internists. Each monthly hour-long session begins with a brief presentation centering on a specific case or on a current topic; questions and discussion follow. These pilot projects are expected to result in annual series of teleconferences for pediatricians and internists, with additional series organized for other specialists as interest grows.

British Columbia

Recent developments in interactive telehealth that have taken place at the University of British Columbia and other institutions in that province have been catalyzed mainly by the Knowledge Network of the West.

With the creation in June, 1980, of Knowledge Network, the educational telecommunications authority of British Columbia, distance education in many areas, including health, was expanded via public, closed-circuit, and satellite

television. Knowledge Network now offers services to over 160 communities with links to off-campus, interior, and remote locations.

Through the University of British Columbia's Communications System, Knowledge Network has installed a system that links the universities, teaching hospitals, and other locations by cable or microwave. Experiments in the use of television in health have been initiated and coordinated primarily by the Division of Continuing Education in the Health Sciences at the University of British Columbia.[17]

The mandate of the Division of Continuing Education is to provide the framework within which health professionals can upgrade their skills so as to improve health care services. To achieve this, the Division regularly offers face-to-face lectures and symposia in various hospitals and teaching facilities in Vancouver. In addition, the University of British Columbia makes available to regional and community hospitals speakers from the Faculty of Medicine. Because of the cost of sending speakers to remote areas, and the difficulties and cost of bringing health professionals from remote areas to attend sessions in Vancouver, it has proved difficult to meet the educational needs of workers in the distant communities.

The creation of the Knowledge Network in British Columbia has offered some hope of changing this situation, and over the past two years a number of programs have been offered through the Network's facilities. Since the Fall of 1981, the Division of Continuing Education in the Health Services has been producing a series of live interactive television programs in continuing medical education for the participating hospitals in British Columbia. The programs, offered throughout the Fall and the Spring, are usually broadcast on five or six consecutive week nights, for one to two hours an evening. They usually take the form of a lecture, followed by a discussion on the air.

In the Spring of 1983, a provision was made for the participants to phone questions in to the lecturer and to teleconference after the program was off the air. This did a great deal to make the sessions more interactive and was appreciated by people who felt inhibited about asking questions during the live television transmission.

Another program offered in June, 1983, was a three-day demonstration project to illustrate how a dependable, confidential television service, delivered by satellite, can help meet the educational needs of health professionals. Involving five participating hospitals, the project transmitted five educational sessions that used lectures and discussions. The topics were of interest to doctors, nurses, allied health professionals and administrators.

In addition to using Knowledge Network's facilities for telehealth, the University of British Columbia will be experimenting with other technologies and systems. In the Fall of 1983, the Continuing Medical Education Section of the Division of Continuing Education in the Health Sciences offered a series of audio-teleconference lectures on a trial basis, in lieu of providing televised instruction. The responses to these lectures will be compared to the evaluations of past televised lectures. It is predicted, however, that over the next few years, audio-teleconferencing will be used in British Columbia for most distance education in health because of its cost-effectiveness.

Video-teleconferences will also carry educational content, but will be less frequent because they take so much time and money to organize. Continuing Medical Education plans to experiment with single-event video-teleconferences that would be telecast through the facilities of Knowledge Network. Such teleconferences would have one-way video and two-way audio and would last approximately three hours.

For the future, it is expected that both audio and video systems will be used in telehealth applications in the province and that they will be combined in innovative ways so as to meet a variety of needs.

Alberta

In 1980, a pilot project using audio-teleconferencing was begun by the Division of Continuing Medical Education (CME) at the University of Alberta in Edmondon. Speaker phones were installed in 15 hospitals in northern Alberta, with the aim of providing continuing education conferences to nurses and doctors in rural communities. Although some technical difficulties were encountered, such as poor quality lines and

delays in linking the sites, the programs were received enthusiastically and judged favorably by the participants.

Since 1982, the University of Alberta has used a Darome bridge* operated by Athabasca University to offer CME programs to small communities in central and northern Alberta. Each site receives one program every two weeks, but each program is given twice - 11 hospitals participate in the first presentation, 15 in the second. A total of approximately 120 doctors attend the programs.

Prior to each session, print handouts and occasionally 35mm slides are prepared by the presenter and distributed to the hospitals involved. Following each session, each hospital completes an evaluation form and submits any suggestions for future programs. Participating hospitals are billed for the teleconference sessions.

The Faculty of Medicine at the University of Calgary has also developed an audio-teleconferencing program that serves southern Alberta. The availability of a teleconferencing bridge at the University and successful experiences with such a system in Edmonton and elsewhere led to the development of two types of trial programs: one program in continuing medical education and another that presented perinatal conferences. The objectives of this trial were to study the feasibility of providing educational programs to hospital personnel using teleconferencing and to determine whether or not these programs fulfill the educational needs of health personnel in rural settings.[18]

Beginning with five interested centres, one trial conference was held in April, 1981, four in the Fall of 1981, and six in the Spring of 1982. The trials clearly demonstrated the feasibility of the technology and of this educational approach. Once again, the response of the participants was favorable, and a steady increase in attendance was seen as the trial proceeded. The technological problems encountered in 1980 were overcome by the use of the Darome 20-20 bridge, which was able to ensure high-quality lines that were quickly connected.

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* An electronic device that links three or more telephone or communications lines into a conference call.

Because of the success of this trial, the decision was made to proceed further with the project in 1982-83. By the Spring of 1982, the project had expanded from five centres to 34 (26 rural hospitals and eight urban hospitals). The rapid expansion is, in part, due to the requests of many hospitals to join the network.

Support for the project has come from many sources. Funding is received from private sector grants, the Southern Alberta Perinatal Education Program, and registration fees from participating hospitals. Staff and office services are made available by the Division of Continuing Medical Education (CME) of the Faculty of Medicine and by the Teleconferencing Centre of the University of Calgary. CME teleconferencing and perinatal teleconferencing are the main programs of the project. The CME sessions have been very successful. They are held once every two weeks, then repeated twice. The sessions are one hour long, and the topics are selected by the rural practitioners themselves, by means of advance surveys and participants' comments after each session.

Support materials are considered an essential component of each teleconference, and generally a prepared text or handout is made available to each member of the audience several days before the teleconference. If the mail is too slow, a courier is used, and the charges added to the registration fees. Training for users is also emphasized; "hands-on" training sessions are provided, and materials have been written to guide the users of the system.

In order to maintain a high quality of instruction during the teleconferences, visiting guest professors were scheduled into the program in 1982-83, and some conferences were able to use out-of-town lecturers who were linked to the network through the Darome bridge.

The perinatal conferences, also an hour in length, are held once a month and repeated once. In this case, the programs are presented by the University of Calgary in conjunction with, and under the auspices of, the Southern Alberta Perinatal Advisory Committee.

On the average, about 18 hospitals have participated in each session thus far. Topics are chosen by surveying the medical and nursing staff of the rural perinatal units and usually reflect relevant clinical problems.

The perinatal program differs from the CME program in a number of ways. Unlike the CME programs (which originate from the University of Calgary), the perinatal teleconferences are conducted from hospitals in the region, in keeping with the policy of the Regional Perinatal Program. As a joint medical-nursing educational endeavour, the aim of this program is to encourage nurses and doctors to apply the team approach to patient care. The presentations, conducted by a nurse-doctor team, reinforce that goal.

Although the effect of both projects on the quality of health care is difficult to evaluate, there have been positive results that in the future may result in improvements in health care:

- Feelings of isolation by health professionals have been overcome.
- Strong ties between hospitals have formed, and a regional identity has been nurtured.
- There is improved communication between rural and urban workers.
- An increase in telephone consultations after the perinatal conferences has been noted.
- Program-related changes in clinical practice have occurred.

Manitoba

Since 1976, when the Manitoba Telephone System became the common carrier of coaxial cable signals, the University of Manitoba has had two dedicated broad-band channels that link its two teaching hospitals in Winnipeg, St. Boniface General Hospital and the Health Sciences Centre. One channel is now used for 26 hours each week to provide undergraduate and graduate medical education. Seven hours each week are used to transmit lectures and question sessions with staff and

visiting professors. The remaining hours show medical rounds, clinical conferences, and interdepartmental case presentations that involve staff and students at both hospitals.[19]

In addition, these educational sessions are recorded on videotapes which are then made available by the University of Manitoba Medical School Library to doctors throughout the province. Faculty department heads select and update a collection of 400 videotapes. A list of the available materials is sent to physicians who can then order copies of videotapes for professional development use. Department heads monitor the number of requests received for each videotape as well as the development of new medical information in order to provide a useful selection of material to practicing physicians in all parts of the province.

The second cable channel is used to transmit diagnostic ultrasound images for medical consultation between the two hospitals concerning pregnacies, abdominal difficulties and cardiac problems. This capability is used almost on a daily basis.[20]

The availability of these dedicated channels has enabled teaching staff and medical specialists to reach both hospitals simultaneously, thereby reducing the need for duplication and travel between them.

More recently, slow-scan systems have been purchased to link the Health Sciences Centre with Victoria Hospital, also located in Winnipeg. Still pictures are transmitted every 15 seconds over telephone lines to television receivers where they are viewed for medical consultation purposes as well as for continuing education activities. A slow-scan connection was also made with Sioux Lookout in northwestern Ontario and there are plans to introduce this capability in The Pas in northern Manitoba.

Ontario

Interactive Telehealth. Interactive Telehealth is a terrestrial microwave telecommunications system that links the University Hospital in London, Ontario with the Woodstock General Hospital, 66 kilometres away. This daily, live-time,

two-way, color television system is the outgrowth of a pilot project that investigated the potential for future development of broad-band television linkages for northern Ontario.

The project was funded by the provincial Ministry of Health and initiated and developed by the two participating hospitals, with full support from the regional District Health Council. The planners who took part were enthusiastic about the project because they thought it would be invaluable in providing health services (especially consultation in psychiatry) to Woodstock. (However, by the time the network was operating, there was no longer such a need for that service because three qualified psychiatrists had moved to Woodstock on the promise of having the system there.)

The decision to investigate a broad-band system was made because the planners wanted to use what they believed to be the most highly developed and desirable telecommunications system available. The Hermes experiments had indicated some of the numerous advantages of broad-band, and members of the London-Woodstock project added their praise: "'Live-time' television allows for a maximum of flexibility in programming, by enabling the health provider to view movement, essential for assessment, diagnosis, and treatment in areas such as psychiatry, physiotherapy, radiology, and speech pathology."[21]

Following the completion of the engineering and economic feasibility study of the interactive television linkage that lasted from July, 1979, to November, 1980, the planning committee decided to lease a dedicated broad-band microwave system from a common carrier under a five-year contract. The system, known as Interactive Telehealth, was officially opened in November, 1980. At present, the system is used mainly for the education of health personnel and for administrative purposes; teleconsultations are provided in a limited way.

On the average, there are at least 10 hours of live programming a week including surgical, medical, psychiatric and obstetrical/gynecological rounds. Other programs are presented on an ad-hoc basis; they have included special seminars in service education, refresher days workshops, and nursing teaching rounds.

The regular use of the microwave system for weekly planning meetings of the Telehealth group and for other administrative functions has proved to be an efficient way to coordinate and plan both day-to-day and long-term operations.

In August and September, 1982, the University of Western Ontario in London, Ontario, ran a six-week experiment using the Anik-B satellite to relay signals to the North Bay Psychiatric Hospital and the Sudbury-Algoma Hospital. Sudbury was linked with interactive video whereas North Bay only received a video signal. The project was a psychiatric series which utilized both a seminar format and some patient presentations. Despite its success, the project has been terminated and it is unlikely that satellite technology will form the basis of a new expanded project in the foreseeable future.

At present, however, there are plans to increase the volume of the Interactive Telehealth's activities by expanding the television system to other hospitals in London, and to neighboring community hospitals.

A significant recent change is that control of the project has been transferred: the Telehealth project is now under the auspices of the University of Western Ontario. Discussions are being held with other possible users of the system, and it is expected that the system will be time-shared with other groups. Those working with this interactive video project endorse the technology enthusiastically and believe that if cost considerations did not come into play, all distance health programs would include it in their technological apparatus. As some of the researchers have said: "The medium provides a sufficiently powerful communications tool to assure its future role in the health care field."[23]

The Royal College of Physicians and Surgeons of Canada Teleconference Project. The Royal College of Physicians and Surgeons of Canada is close to completing a two-year pilot project, using the teleconference system that it shares with the Toronto General Hospital.[22]

Titled "The Royal College Teleconference Project" (RCTP), the project was developed in cooperation with Memorial University and the Toronto General Hospital project (the

Toronto General Hospital project was later known as the "Telemedicine for Ontario" Project).

The project's objectives are: (1) to explore the potential of teleconferencing in the various activities of the College, with emphasis on continuing medical education, administrative uses, and committee meetings, (2) to share the teleconference system with other national health and education organizations and agencies. In planning and implementing the project, its director is working with the directors of continuing medical education at all 16 medical schools in Canada. The Royal College System includes a Darome microphone speaker kit which has been distributed to each of the 16 medical schools and to a number of teaching hospitals in areas that do not have medical schools. A person has been identified at each of the peripheral sites to coordinate the use of the equipment and to arrange bookings.

Since the official launching of the project in the Fall of 1982, major strides have been made in achieving both of the stated objectives, and the use of the bridge has been considerable. National as well as provincial and regional teleconferences have been conducted, with all Canadian provinces and the two territories taking part.

It is too early to report on the project, but its evaluation should be well underway by the Winter of 1984 and the future of the RCTP will be decided then. To date, the Royal College System has been used for regular administrative meetings of the College and its many specialty committees and for a number of national continuing medical education programs. These have included neurological, clinical, pathological conferences involving five medical schools, a national program on AIDS, and an orthopedic conference which has also involved all 16 medical schools. A major effect of the Royal College Teleconference Project has been the development of an interest in teleconferencing in many local and regional areas across Canada.

It is anticipated that if initial results are confirmed there will be a continuation of some form of teleconference programming within the College beyond the life of the project.

Telemedicine for Ontario. The "Telemedicine for Ontario" project began as part of the Royal College of Physicians and Surgeons/Toronto General Hospital Joint Teleconference Project. It is another project that is exploring the potential of audio-teleconferencing in the delivery of continuing education for health professionals in distant sites. This two-year pilot project is being developed out of the Toronto General Hospital (TGH) in cooperation with the University of Toronto. Funded by the Ontario Ministry of Health, a private foundation, and user fees, "Telemedicine for Ontario" has as its primary objective the delivery of a series of programs in continuing medical education (CME) to health professionals in hospitals throughout Ontario. The presentation of various CME programs is coordinated by the project in cooperation with the University of Toronto and other university CME departments. Sessions are also offered to all other health professionals in Ontario, in collaboration with nursing and allied health agencies.[24]

The Royal College of Physicians and Surgeons supported "Telemedicine for Ontario" by funding 50 per cent of the project. Toronto General Hospital received funding from other sources including the Canadian Donor Foundation. The capital and operating expenses of the teleconference system are shared with the Royal College of Physicians and Surgeons of Canada, which is entitled to half-time use. The two groups are joint owners of a Darome bridge which has the capacity to link as many as 20 sites in a conference call. The participating sites are generally equipped with a set of microphones and a speaker. This particular technology was chosen because experience elsewhere (e.g., in Newfoundland, Alberta, and the United States) had proven it to be an effective and cost-efficient way to provide continuing education and administrative activities to isolated health professionals. The bridge has been made available to any health agency in Ontario that wishes to mount its own series of programs, or to become an affiliated user. Although the bridge is used primarily for straight audio-teleconferencing, it has been found that it can function in a very satisfactory manner with slow-scan applications (for example, it works smoothly in linking up the Toronto-Sioux Lookout Zone project).

As part of the continuing education series, several sets of programs were organized for doctors, nurses, and allied health professionals in northern Ontario in 1982-83 after an

initial trial period in the Spring and Summer of 1982. By the Spring of 1983, the continuing education series was well-organized and offered a broad selection of topics for a varied audience. For example, consider the makeup of the program series for April to June, 1983:

- general medical subjects
- specialty rounds
- a weekly program in emergency medicine
- a bimonthly journal club
- weekly programs for nurses
- a weekly program for allied health professionals
- a weekly program for outpost physicians and nurses (sponsored by the Hospital For Sick Children and the Sunnybrook Medical Centre)

In addition to the continuing education series, the teleconference system is used extensively for administrative purposes such as committee or association meetings.

In the planning of the programs, the participation of the health professionals is solicited and their expressed needs are incorporated into the series. This process is facilitated by surveying outlying hospitals by mail, over the teleconference system or by personal visits. The form of the program varies with the topic; most often it is either a lecture and discussion or a panel discussion.

The staff of "Telemedicine for Ontario" encourages and supports user training, and helps users to master what it considers the keys to success in teleconferencing: organization, participation, personalization, interaction, and feedback.

As in the audio-teleconference projects referred to previously, support materials are considered useful tools for enriching the sessions. Slides, overheads, and printed materials are the most frequently used; three weeks' lead time is requested for their duplication and distribution.

Some of the programs have used a moderator to chair a series of sessions. This person can be a great asset to a session by introducing the guest speaker and participants, encouraging interaction, and so on.

The "Telemedicine for Ontario" pilot project is near the end of its term. It is already clear, although a complete evaluation is yet to be done, that audio-teleconferencing is extremely useful in the delivery of continuing medical education. However, that does not prevent TGH from looking toward other telecommunications systems as well. As resources permit and as the need arises, it is planned that an increasing number of technologies will be used in conjunction with the bridge.

Quebec

Sacré-Coeur Hospital. Sacré-Coeur Hospital, a teaching hospital of the Université de Montréal, has been working with communications technologies since 1971. Using telephone lines, a telesurveillance system was set up whereby up to 14 patients' electrocardiograms (ECGs) were transmitted from distant hospitals to Sacré-Coeur where they were monitored by a full-time nurse and a supervising cardiologist. By 1978, the nurses at the distant hospitals had been trained at Sacré-Coeur to provide this function, making further telesurveillance unnecessary. Since then, the system has been used when needed for consultation in special cardiac cases.

In addition to the live transmission of ECGs, Sacré-Coeur has developed a second telephone service using watts lines to receive and analyze ECGs from distant hospitals. Starting with one hospital in 1971, the ECG Centre grew to service seven hospitals by 1975. As the Centre continued to expand, the need for a computerized system became clear. An appropriate computer system was purchased and installed in 1981. Today the service is used by a total of 20 hospitals, most located in the northwestern part of the province, with a few in the Montreal area and the eastern region. The ECG Centre analyzes 200 ECGs received each day, as well as the 150 ECGs done at the hospital.

During the late 1970's, Sacré-Coeur, along with the Hôtel-Dieu Hospital and the Institut de Génie Biomédical used the Anik-B satellite to link Montreal and two sites in James Bay. While the one-way video and two-way audio system were found very useful, the satellite costs were high and the service ended once the experiment was completed. A slow-scan system was used to replace the satellite communications but

was not found to be worthwhile and at present, a telephone link only is maintained.

During the past two years, this telemedicine service has been developed to provide telephone consultations between physicians in several of the hospitals involved in the ECG service and a variety of specialists at Sacré-Coeur. At present, approximately 70 consultations occur each month.

Sacré-Coeur Hospital is also involved in a monthly teleconference with the hospital in Ville Marie, a town in the northwestern region of Quebec. Physicians in Ville Marie can consult with specialists at Sacré-Coeur informally during teleconference sessions. Similar discussion sessions are being considered among the nurses at the two hospitals.[25]

Medical school teleconferencing. Beginning with smaller teleconferences among medical schools and hospitals to provide continuing medical education, a Quebec network has developed over the past few years. In conjunction with the Royal College of Physicians and Surgeons, Quebec's four medical schools - McGill University in Montreal, the Université de Montréal, Université Laval in Quebec City, and the Université de Sherbrooke - and approximately 15 hospitals now participate in occasional teleconference sessions that present formal lectures. Each medical school prepares one or two sessions each year.[26]

Télé-Santé. Begun in June, 1983, Télé-Santé is a Telidon service designed to provide public access to health care information.[27] While telehealth projects in other provinces are used to help medical professionals to confer and consult in diagnosing and treating health problems to further their education, Télé-Santé provides health care information to the general public. Sponsored by the Clinical Research Institute of Montreal, the Montreal General Hospital and the Rivière des Prairies Hospital, Télé-Santé is comprised of one page creation terminal and 10 user terminals located in clinics throughout Montreal. At present there are 350 pages in the system (50 in English and 300 in French). By December, 1984, it is expected that 12 user terminals will be in operation and the total number of pages will be 2,900 (1,300 in English and 1,600 in French).

The aim of Télé-Santé is to assist individuals in making better health care decisions. Once the user enters personal information into a terminal, the terminal performs some of the preliminary diagnostic work that is normally carried out by a physician. It not only provides specific information on specific illnesses, but also trains people to take a broader view of what constitutes health and effective health management. Content is now being added and will eventually cover the following subjects:

- depression
- youth health problems
- eating habits
- alcohol abuse
- smoking
- choosing a health service and a doctor
- infections/childhood diseases
- vaccinations
- insomnia
- fatigue and stress
- headaches
- colds and fever
- digestive problems
- heart problems
- risk factors

New Brunswick

Several hospitals in Health Region III, an area approximately 240 kilometres wide in the western part of the province of New Brunswick, introduced teleconferencing for an initial five-month trial period from February to June, 1983. The objectives of this trial were to explore the use of audio-teleconferencing for continuing education, administrative applications and meetings for health professionals, as well as evaluate the use and acceptability of teleconferencing, both from a technical and a program viewpoint.[28]

Eight hospitals participated during the initial five-month period; bridged by the services of New Brunswick Telephone. Each site was equipped with Darome convenors and microphones.

Medical contacts at each site, as well as the Region III Education Committee, developed programs for the Region. Some medical programs were also teleconferenced from Memorial University in St. John's, Newfoundland and the Royal College of Physicians and Surgeons in Toronto. The programs attracted a wide spectrum of hospital personnel in Region III - from physicians, nurses, dieticians, and pharmacists to technologists, and administrative and education staff.

During the trial period, the Dr. Everett Chalmers Hospital in Fredericton conducted weekly grand round medical sessions. Programs teleconferenced throughout Region III included, for example, Hepatitis Update and Prophylaxis, Diabetes in Children, Surgical Treatment of Stroke and TIA, Acute Pancreatitis, and Pitfalls of the Pharmacological Treatment of the Elderly. In September, 1983, the Chalmers Hospital continued to provide these grand round medical sessions, and it is hoped to have them accredited by the Canadian College of Family Physicians for Continuing Medical Education. Formats such as seminars, case presentations, clinical pathological conferences, and peripheral hospital presentations are to be utilized as part of the Fall 1984 programs.

Also during the trial period, the Region III Education Committee conducted several programs by teleconference throughout the Region from the Dr. Everett Chalmers Hospital. Their sessions included such topics as Anticoagulant Chemotherapeutics, the Disturbed Patient, Evaluation of Fluid and Electrolyte Data, Pain Control, and Legal Aspects of Charting. This committee is revising their program to recommence in 1984.

While each of the initial teleconferences was very much of an experiment in equipment-usage presentation and program format, users have now become quite familiar with the system; are comfortable in its operation, have increased their participation, and have expressed much satisfaction with the programs. Sessions which incorporated visual aids, such as slides or pre-distributed handouts, were particularly well received by participants.

It should be emphasized that this teleconferencing activity is a regional program and that its strength depends on active participation by all facilities. Region III looks

forward to the continued use of teleconferencing in promoting health care.

Newfoundland

Another example of the widespread expansion of audio-teleconferencing in health is found in Newfoundland. Encouraged by the success of the Hermes trial in teleconferencing in Newfoundland in 1977, the telemedicine group of Memorial University of Newfoundland decided to develop a province-wide, audio-only teleconference system, using modified telephone technology. This technology was considered the cheapest and simplest technology available to meet the needs for distance communications. The fruitful results of this decision are seen today in the well-established, extensive, audio-teleconference system that spans the province.

A special feature of the system is its ability to link into the teleconference network up to three participants from any place with a reliable telephone connection. The network also has the capacity to record all programs if required, and it permits pre-taped conversations to be played during a conference.

The control centre of the system is located at the Health Science Centre and is staffed regularly from 0800 hours to 2200 hours, Monday-Friday, and at other times as required for bookings. The system is coordinated from the control centre and there are site coordinators at each of the sites on the system. The system is now in use approximately 14 hours a day, five days a week.

Initially in 1980, the project linked 13 communities in the province with a number of sites in St. John's via the first dedicated, four-wire, ground-based teleconference system in use in Canada. Early in 1981, province-wide expansion began. By the Spring of 1983, the system comprised about 40 sites and some 70 buildings. All hospitals, some government buildings, a nursing home, university buildings, and seven vocational schools became part of the teleconference network. Without a doubt, this system has now become a significant part of health and education activities in the province.

Although the teleconference system initially received substantial grants from the federal government, along with university and local support, it is now paid for mainly by its users. To achieve that state, it was essential that there be a consortium of users to pay the not-inconsiderable cost. Indeed, the list of users is now long, including about 40 different organizations and agencies that pay user fees. Various grants are also received to help support the system. This shared funding has allowed the system to make the transition from an externally-funded research project to a self-supporting operating service within five years.

The Memorial University teleconferencing system, available to all hospital groups and health agencies, is used for a wide variety of purposes and multidisciplinary activities. The main uses are for continuing education of health professionals and other health workers, administrative purposes, and transmission of medical data for patient care.

The following list of recent activities will illustrate some of the applications of the teleconference system in continuing education in health:

- The Office of Continuing Medical Education in the Faculty of Medicine organizes up to five hours a week of continuing education programs for physicians practising in remote parts of the province. The programs usually consist of short, didactic segments alternated with interactive discussions. These sessions, as well as being educational, also serve as forums to allow medical consultation at a distance.

- Weekly medical rounds (pediatric and ambulatory) are held. They originate from the pediatric centre in St. John's and are designed for doctors in general practice.

- In 1980, 20 pathologists at about five teleconference sites were linked to a program that was sponsored by the American Society of Clinical Pathologists, originating in Missouri, U.S.A. The three-hour program used pre-circulated slides and written materials. The participating Newfoundland physicians were generally pleased and praised the system for allowing them to take part in an international symposium with over 500 participants.

- Programs in continuing education for nurses, dietitians, physiotherapists, pharmacists and other health workers are offered regularly.

As was seen with the University of Calgary teleconference project, the Memorial University project also provides training for users and encourages speakers to use support materials. Supplementing audio programs helps to satisfy the visual needs of many students. Persons who have in the past taken credit courses by noninteractive videotape stated their clear preference for interactive audio courses supplemented by limited visual material.

In addition to its use in continuing education, the teleconferencing system is also used extensively for administrative functions such as planning and committee meetings. The user groups have included: the Newfoundland Cancer Foundation, the Canadian Diabetic Association, professional associations for health workers, the Newfoundland Hospital Association, the Department of Public Health, and various hospital groups such as inservice directors, infection control officers, and laboratory technicians.

Although Memorial University's telehealth system is intended primarily for educational and administrative purposes, there has been a gradual increase in the use of the facilities for consultation and diagnosis. At selected sites, the transmission of medical data via slow-scan television is being explored. At present, four remote hospitals are equipped to transmit EEGs and regular weekly transmissions are made to St. John's. It is expected that ECGs will soon be transmitted from a number of sites. Various other uses are also being considered, and limited field trials are planned for early 1984.

ISSUES IN PLANNING FOR TELEHEALTH

By examining the research and field trials of communications technology in health, valuable lessons can be learned in planning for telehealth. As teleconferencing and other interactive media are being used to improve telecommunications in health, several important issues have arisen for consideration in planning future projects.

The experiences with the telehealth projects show that there are four requirements for the adoption of any technological innovation: reliable hardware, instruction for the users, good software, and organization. Reliable technology is available now. The issue is what the users need and whether the technology can be used to meet those needs. It is imperative that in the selection of the technology this issue be scrutinized. And it is also important to evaluate a system once it has been adopted.

With respect to the technology, the University of Western Ontario addresses that debate as follows:

> "The main debate on technologies centres on the comparison between narrow band (so-called 'slow-scan' transmissions, or still video transmissions using telephone lines) and broad band systems (using microwave signals over land-based towers or satellite transponders to produce live, colour, moving television pictures).
>
> It should be remembered that in some ways these comparisons are fallacious, as the two technologies really offer different advantages. In a sense, therefore, apples and oranges are being compared which does not lead to a clarification of the issue. To state again, it is our opinion that the technology will fall into place once the identified needs of a region to be served are known - that in some areas at least, less sophisticated technology might suffice."[29]

An even more basic issue that is the subject of much debate in telehealth is the question whether video is needed in addition to audio. Although broad-band video is at present extremely expensive, there are those who firmly believe that only this technology will completely meet the needs of distance health care and education. Others,

considering the current cost of broad-band video, believe that until the price comes down, it is more practical to use narrow-band technology and take advantage of recent technical advances that enhance the capacity of these less expensive networks.

It is significant that because of the use of cable and microwave systems, broad-band video is already available in a number of urban or densely populated regions at a reasonable cost per person. Rapid technical progress may make the technology feasible for rural and remote areas in the foreseeable future.

A comment from Dr. J.H. Mount from the University of Western Ontario provides valuable input to program design issues and the technology debate:

> "The different technologies not only are capable of doing different tasks, but different styles of input can result, because of the differing technologies. For example, although broad-band in the London-Woodstock link results in about 95% of the content being educational, it is of a different educational format than used on audio-teleconferencing. Basically, we do not do lectures, but rather the format of Rounds is what is televised. This format lends itself easily to television, as it involves a high turnover of information, a lot of that being visual in nature. For instance, in Psychiatry, taped interviews of the patients are presented, rather than the verbal description of the patient. In other medical disciplines, Xray motion studies have been shown, and many Xray films can be reviewed quickly, with the radiologist actually pointing out the deficiencies visually, rather than verbally at the time of the presentation. Physical signs on patients are also demonstrated well, and gross and microscopic pathological specimens are seen in colour. In our experience at least this style of format has been highly attractive to the audiences in Woodstock, and this forms a core of our weekly programming... Another significant advantage however to the broad-band issue is that the presenters do not have to prepare a lot of the material in advance; the organization to distribute the information to the remote audience is therefore lessened, and we have little trouble in getting presenters on a repeated basis to participate in broad-band transmissions. Having been

> involved in the past in audio-only teleconferencing, I can assure you that this ease of preparation is a substantial feature when we are asking busy clinicians to give up time to deal with remote audiences."[30]

For physicians, telecommunications systems used in health care delivery may raise some medico-legal questions. For example: What constitutes a telehealth consultation and what is the method of remuneration for medical services rendered via telecommunications? How can the protection of sensitive and confidential information transmitted via telecommunications systems be guaranteed? Although these issues have not yet caused serious problems in any of the Canadian telehealth applications, they do show that further studies may be needed and precautionary guidelines set, so that complications arising from telehealth will be avoided as far as possible. The University of Western Ontario addressed the issue of telehealth and legal liability. They stated that litigation as a result of using telemedicine in the delivery of health services has not been reported although it has been raised as a concern by the medical practitioners. Legal opinions indicate that the system that most closely approximates that of the "physically present" consultation would be the easiest to defend were such legal action undertaken. Broad-band technology permits such an approximation to occur.

> "Exchanges of information with the Canadian Medical Protective Association indicate that members of the medical profession who continue to practice utilizing this newer style will retain the protection offered by CMPA. They caution however, that a physician should be careful in deciding which tasks are delegated to a non-physician at the remote end. The consulting physician should be familiar with what the provincial College of Physicians and Surgeons guidelines are with reference to delegation of specific tasks. The restrictions imposed by this regulation would, of course, be minimized, if the consulting physician were speaking with another physician at the remote end, rather than another health care worker.
>
> Specific consent forms have been developed, with the assistance of the hospital solicitors. These forms relate not only to the actual broadcast, but also to the possibility of videotaping it, and the conditions and duration of the showing of the videotapes."[31]

The relevance of "teachware," which may be defined as the efforts made to help people learn how to use the innovations, becomes very clear when one realizes that the existence of a telecommunications technology will not automatically guarantee that it will be accepted and used. It is important to note however, that it is not enough to teach people how to use the systems unless they can appreciate the value of telecommunications and apply it to their own field.

Attitudes are often one of the most complex barriers to people using the new telecommunications systems. Potential users may have negative feelings toward technology or be afraid of failure (either with the equipment itself or with the participating audience); they may not know the potential of the technology and may have had a poor introduction to it; or they may have been taught by an instructor who discouraged interaction.

For those reasons, user training, instructor preparation, and the quality of the programs have become important considerations in the planning of telehealth projects. Training manuals have been developed for users, and what is more important, demonstrations that help the user to understand and operate the equipment are commonly provided.

There is a strong need to develop more expertise and provide more guidance in creating the programs that are transmitted using the technology (i.e., the software). Little has been written about how to develop programs that can facilitate learning, i.e., how to foster effective learning with the technology, how to have as much interaction as possible, and how to develop high-quality programs that meet the learner's needs. This is clearly an area that can benefit from further research.

Sometimes the reluctance on the part of health workers to use the new technology may arise from their belief that technological applications will have a negative impact on the relationships among medical professionals and administrators. It is important to consider that there are numerous, diverse, and competing interests in this area. Within the notion of communications technology lies the implication of a power relationship. It is possible that some people may find the introduction of a telecommunications system threatening.

The way that telehealth is introduced will also determine whether or not the system is accepted and used. It is important to talk to the potential users of the system and to include them in the planning. The introduction of the technology may present a substantial change in many aspects of the user's work, and frank consultation with, and inclusion of, health and administrative personnel in the decisions regarding the technology can go a long way to diminish future problems. This philosophy is reflected in the position taken in the Telehealth Program of the Ontario Ministry of Health:

> "Although the process from concept to implementation may be prolonged, it is our belief that to generate a sense of ongoing responsibility and commitment by potential users requires their active involvement in the planning, management, and administration of a telehealth network."[32]

Finally, it is essential to address organizational considerations when planning for telehealth innovations. This includes funding, personnel requirements, organizational structures, and evaluation. All groups working on telehealth projects recognize that sound management and organization are crucial.

> "Unless the administrative groundwork is carefully laid to ensure medical and administrative support, the system, regardless of the level of technological sophistication or the enthusiasm of the participants, will not be used."[33]

Besides requiring good organization, communications technology also depends on considerable capital expenditure. The technology is certainly not cheap, and research is being conducted today in an attempt to develop, implement, and coordinate telecommunications systems in the most cost-efficient way.

In general, the reduction in the number of patients transferred to distant hospitals does not offset the costs of telehealth operation and equipment; to justify these costs, one must look to the educational, social, and administrative benefits.

To prevent extensive duplication and to use the technology more fully, large-scale coordination and cooperation are essential. Networks are thus being considered for sharing technology and programs, and the feasibility of developing multipurpose systems with both health-related and non-health-related users of the system is also being examined.

FUTURE DIRECTIONS FOR TELEHEALTH

As more and more people look to telecommunications technology as a means of improving health maintenance, it is expected that greater efforts will be made to conduct research on the technological systems, their uses, and their costs and benefits. The federal Department of Communications has contracted with Woods Gordon for a feasibility study of national health telecommunications facilities. It can be expected that channels will be set up to exchange telehealth information and experiences.

As newer, more sophisticated telecommunications products and services enter the marketplace and become economically feasible, alterations in the telehealth scene are inevitable. A proposal has been submitted to the Canadian Radio-television and Telecommunications Commission by a privately-owned Canadian health network seeking a license for a national cable television speciality service that would provide information for health professionals and the general public. It has been predicted that very soon slow-scan television and electronic mail will be in common use and that other new systems such as videotex will be incorporated into the telehealth network.[34] Already, some hospitals in Canada are developing the use of Telidon in pharmacy services, for patient information, in drug information services to hospital staff, and for patient education.

This marriage of computer and telecommunications technologies is a natural match, and the use of computers in medical systems will inevitably increase. It is likely that computers will be used more and more to store, manipulate, and retrieve health information and, ultimately, public access to medical computer systems could handle many routine health needs and serve in consumer health education. Also expected is an increase in the automation of the diagnostic process.

The development of "hybrid systems" is expected to grow, with broad-band and narrow-band technologies being combined in various ways. The rapid advances in the field of fibre optics hold great promise here, especially for transmission systems in metropolitan areas.

While the future of telehealth in Canada is probably ensured, there is much work ahead in effecting the timely and prudent use of technology in health care. A combination of approaches will be necessary to explore and assess the benefits of the telecommunications technologies.[35]

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MAP OF CANADA, listing telehealth projects and showing their locations.

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